Space Weather Technical Forecast

Issued on Sunday, 31 July 2022 at 13:07 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight Chance of G1/Minor Storm intervals, most likely on Days 1 or 2 (31 Jul-01 Aug).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been very low over the past 24 hours, with no significant flares. There are currently two sunspots on the visible disc, with the new spot in the southwest quadrant having now faded. AR3068 is the largest region, with little change in the last 24 hours. AR3062 near the southwest limb remains small and simple. A filament eruption observed lifting off in the far southeast quadrant early on 30 July produced a CME, which is now considered unlikely to be Earth directed. No further Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, may be showing indications of a CIR ahead of a HSS. Wind speeds were slow-ambient in a range 320-370 km/s. Density has been average or above average, peaking at 18ppcc just after 30/1200 UTC. The total interplanetary magnetic field (IMF), Bt, was weak to moderate, but recently started rising to peak at 13nT. The north-south component, Bz, fluctuated moderately at times, between +/-8nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at background levels. The high energy electron flux (greater than 2MeV) varied between background and moderate levels, with a brief peak at high levels of 1070pfu observed at 30/1455 UTC. Electron fluence showed a slight rising trend before levelling off, remaining well below the Active threshold (1e8 integrated flux), with an observed fluence value of 2.62e7 integrated pfu recorded at 31/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low or very low solar activity is expected to continue, with only a very slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are currently expected. Solar winds are currently at slow-ambient levels ahead of a possible weak HSS from CH04/+ which may reach Earth during Day 1 (31 Jul). This feature has been closing up as it moves across the disc and may not give any significant enhancement at Earth, however. A stronger enhancement is possible from CH07/- (a northward extension of the southern polar crown) early on Day 2 (01 Aug), slowly easing through Days 3 and 4 (02-03 Aug). With Earth well north of the solar equatorial plane, there is some uncertainty as to whether this will be seen at Earth.
Quiet geomagnetic activity may become Unsettled with Active intervals and a slight chance of G1/Minor Storms with the arrival of any HSS, either on Days 1 or 2. Activity should slowly ease through Days 3 and 4.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at background to moderate levels, but with a chance of rising later to

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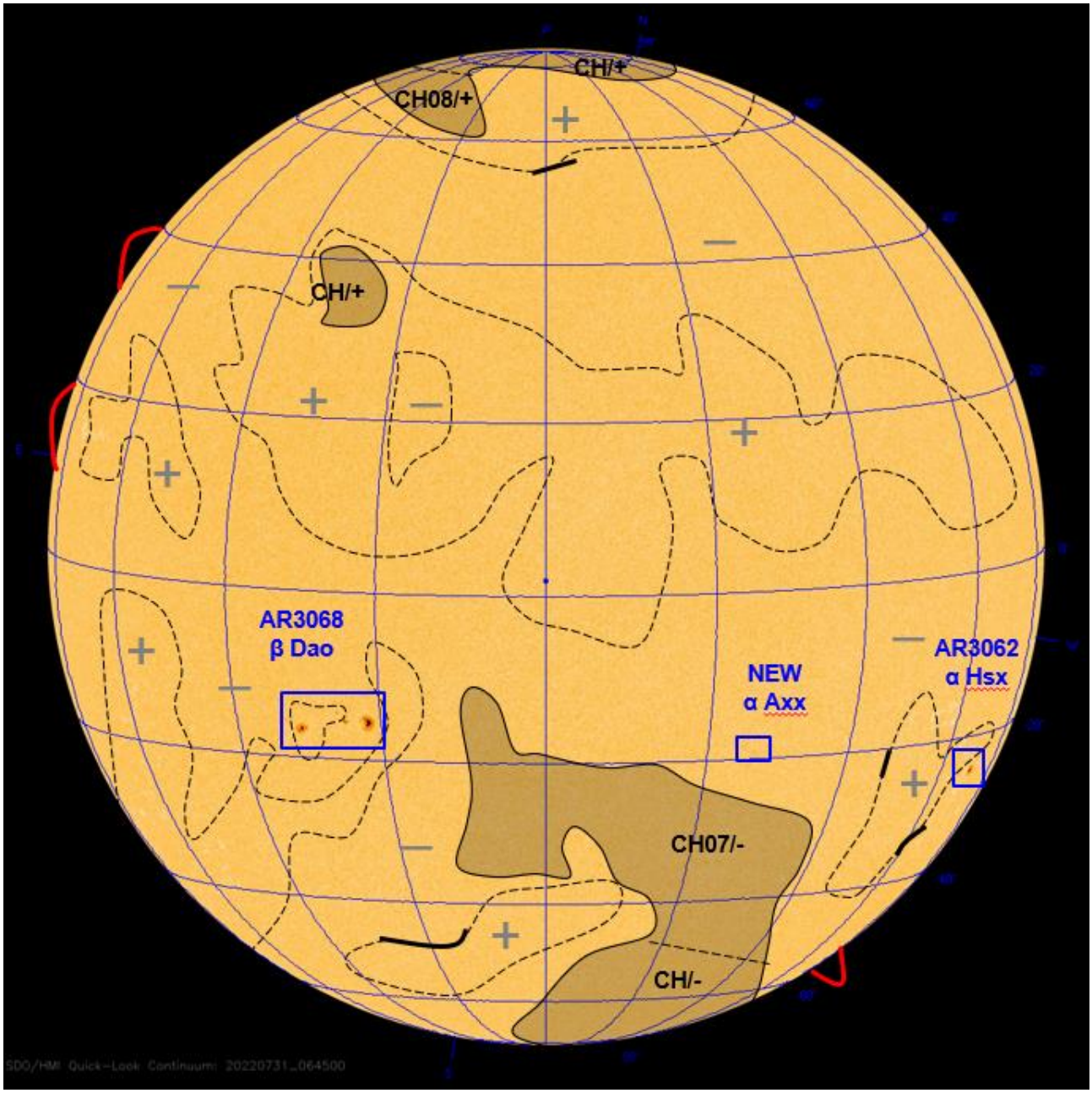
give high levels at the diurnal maxima. The corresponding 24 hour fluence is most likely to remain below the Active threshold (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 31/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth directed CMEs are currently expected. Solar winds are currently at slow-ambient levels ahead of a possible weak HSS from CH04/+ which may reach Earth during Day 1 (31 Jul). This feature has been closing up as it moves across the disc and may not give any significant enhancement at Earth, however. This uncertainty is compounded by the lack of useful persistence data. Enlil has a strong and broad enhancement from Day 1, which appears to originate from CH07/- (a northward extension of the southern polar crown). With Earth well north of the solar equatorial plane, there is some uncertainty as to whether this will be seen at Earth. A possible enhancement (with limited data available) at STEREO over the last 24-36 hours may relate to CH07, although STEREO is 2 degrees further south than Earth and may experience a stronger connection. This would suggest a potential enhancement at Earth from CH07 early on Day 2 (01 Aug), slowly easing through Days 3 and 4 (02-03 Aug).

Quiet geomagnetic activity may become Unsettled with Active intervals and a slight chance of G1/Minor Storms with the arrival of any HSS, either on Days 1 or 2. Activity should slowly ease through Days 3 and 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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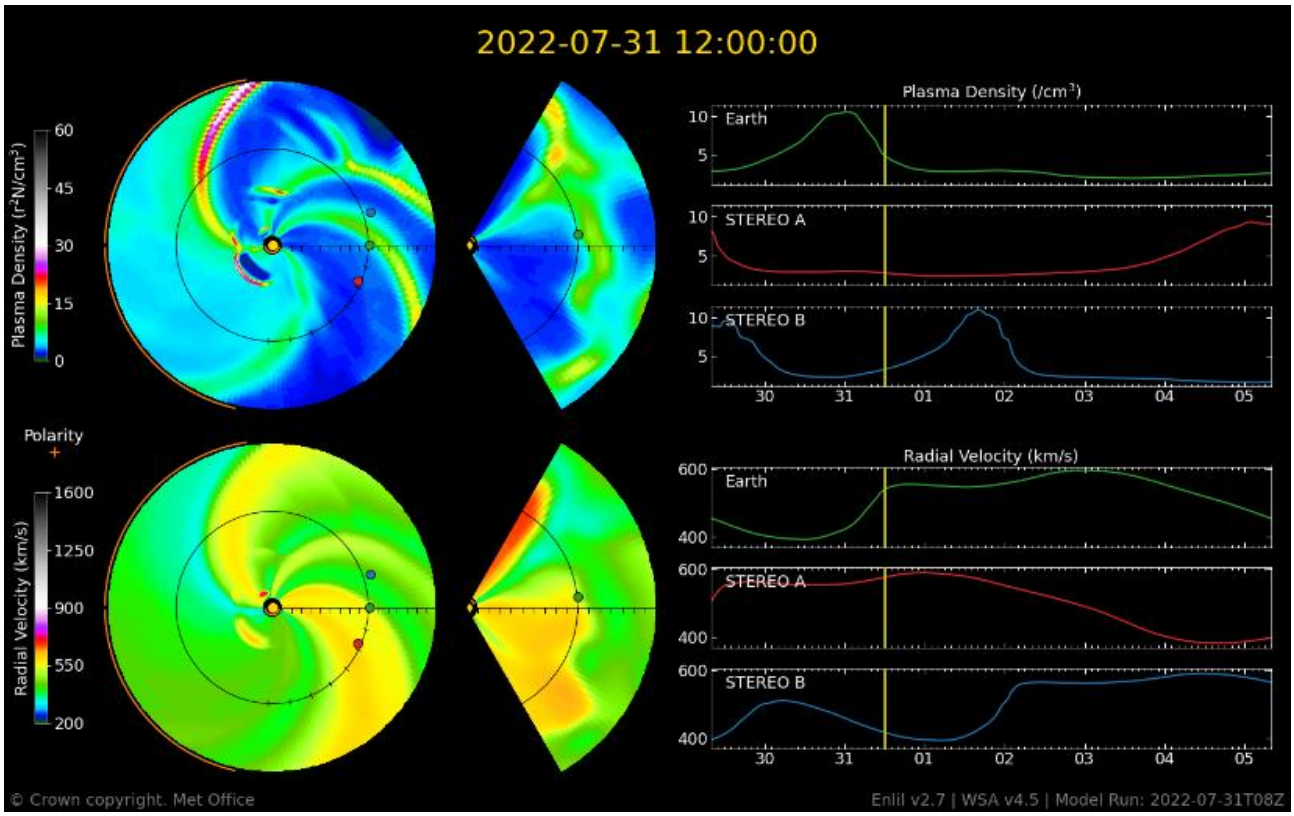
Figure 2: Met Office Enlil model showing a broad high speed stream (HSS) through the next few days, likely from CH07/-. This may be overdone, given Earth's position well north of the solar equatorial plane, and the coronal hole being south of the solar equator.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar activity is currently very low, with no significant flares. There are now just two sunspot groups on the Earth-facing disc, with the unnumbered spot in the southwest having faded. The largest region is AR3068 (Dao/Beta) in the southeast. This remains relatively stable with just some minor spot proliferation in recent hours. AR3062 near the southwest limb remains small and stable. STEREO imagery suggests the potential for further active regions to rotate onto the Earth-facing disc through the period, although it is difficult to assess the likely activity of these regions until they become visible over the east limb. Activity is expected to remain Low or Very Low, with only a slight chance of rising to Moderate from any M-flares, most likely from AR3068.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is expected to remain at this level through the period.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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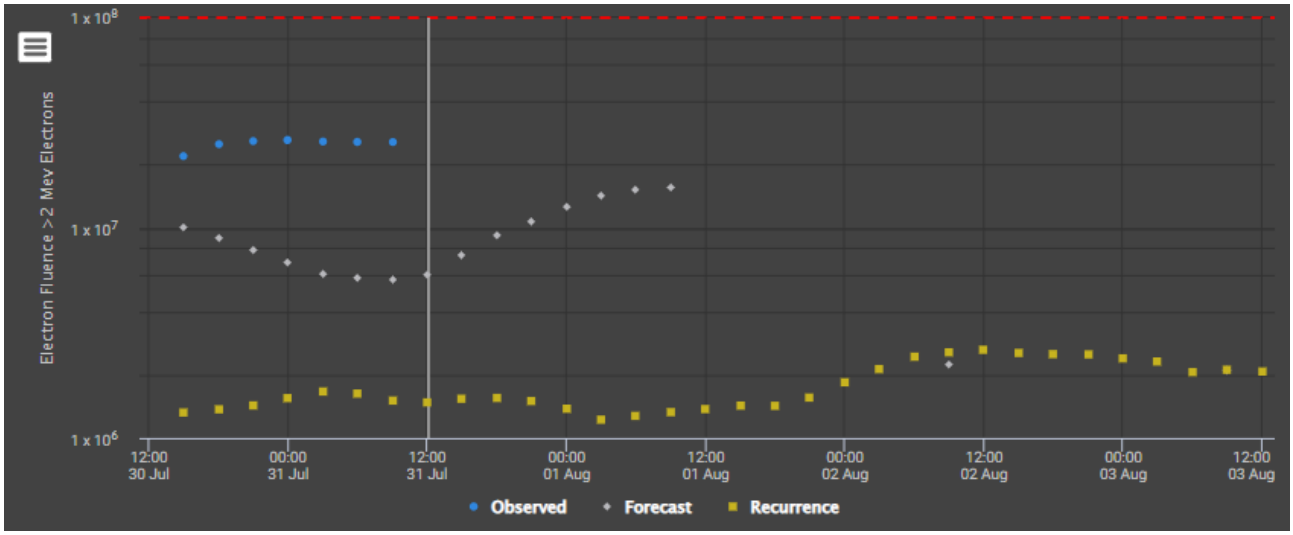
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) as measured by GOES-16 briefly peaked at High (1000 pfu) levels yesterday, but has since been at largely background levels. There is some uncertainty in the solar wind forecast, but with a possible HSS expected either Day 1 or Day 2 (31 Jul-01 Aug), an increase in wind speeds may occur. If this happens, it may drive some electron charging later in the period but this is low confidence.

The corresponding 24-hour fluence will most likely remain below the Active (1e8 integrated pfu) threshold through the period. Any enhancement is unlikely to bring sufficiently persistent High flux to reach the Active level. Met Office REFM also supports well below Active fluence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM, suggesting a well below Active trend. This seems reasonable, although may be a little too low with a slight increase possible towards the end of the period.



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